Oceanographic DataLink

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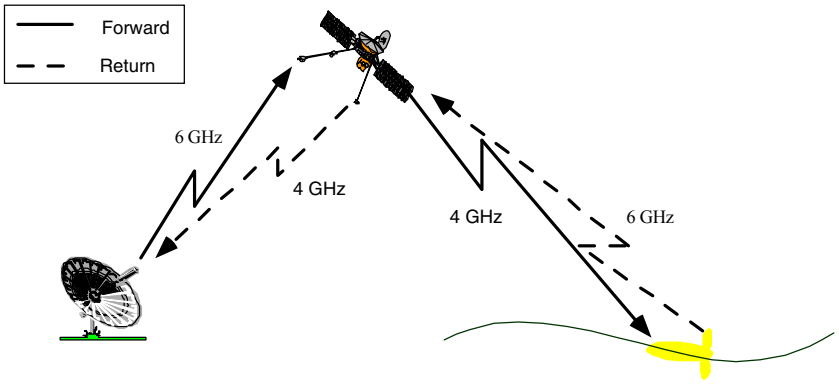
LONG-TERM GOAL

ViaSat's long term goal is to develop and demonstrate a global two-way datalink for collection of environmental data from platforms at sea. The proposed datalink would provide a two-way datalink with 10 to 100 times the capacity of ARGOS at a fraction of the yearly cost. This datalink uses existing commercial, geosynchronous satellites.



OBJECTIVES

During this two phase Small business Technology Transfer (STTR) effort, ViaSat is working with the Autonomous Undersea Systems Institute (AUSI) to test and demonstrate the proposed datalink on their solar powered Autonomous Unmanned Vehicle (AUV). The initial tests included testing of a prototype with a directional antenna that required positioning of the vehicle. Future tests include testing with a prototype "omni-directional" antenna. Additional tests will be conducted under related programs for a number of other marine and land based applications. These demonstrations will be primarily functional rather than a form/fit demonstration.

APPROACH

This datalink is based on the Remote Environmental DataLink (REDL) design developed under a previous ONR SBIR. Over the last two years, ViaSat has finished this design, conducted hardware and software integration and completed in laboratory testing. Initial demonstrations included a one way demonstration at the AUV Fest in November 1999 and an in-water demonstration using AUSI's Energy System Testbed (EST) in February 2000. Further demonstrations are planned for the Spring of

2001 that utilize Turbo codes. These codes can provide the same throughput at half the transmit power.

The current prototype is based on a directional antenna. The approach for the remainder of this effort is to integrate the Turbo codes into the current prototype to support operation with an "omni-directional" antenna. In addition, improved power management and component size reductions will result in an updated prototype that will more closely resemble the production unit. The new prototype will be designed and packaged for AUV, tactical buoy, and asset tracking applications. The SAUV AUV is the AUV to be demonstrated in this effort and the RACOM III buoy is the basis for the tactical buoy demonstration. Additional demonstrations and applications are currently being considered for Spring 2001 testing.

WORK COMPLETED

Previously the terminal design, integration and test were completed along with the installation and test of the 4.5m demonstration hub. Access to INTELSAT 801 was authorized and considerable in lab testing was completed. However, many system issues remained to be addressed. The focus of this year's efforts was to complete the system design and conduct several demonstrations to confirm the technical feasibility of the proposed datalink.

ViaSat's involvement in the 1999 AUV Fest in Gulfport was instrumental in completion of a majority of the system design issues that remained. This was the first demonstration of the synchronization and tracking algorithm which allowed the system to be tested for the first time out of the lab. Even though it was a one-way demonstration, it required successful operation of these algorithms. Over the next several months, the algorithms were enhanced and improved, and in late February, ViaSat and AUSI demonstrated a two way datalink in the water of off New Hampshire. This demonstration used the AUSI EST as a representation of their SAUV AUV. The demonstration confirmed the ability to monitor and control a remote marine vehicle by requesting and receiving regular position reports. These reports were provided to users over the internet using AUSI's visualizer.

The data transmitted in the first two demonstrations consisted of short random, intermittent messages. Further testing in the Spring of 2000 focused on longer more regular messages. The results of these tests indicated further work was necessary to support such applications. In addition, the fragility of the prototype became apparent during these later tests and work continued to the end of this reporting period to stabilize and characterize the performance of the prototype.

Finally, considerable effort was directed towards the Turbo code design and the new hub board. This board was designed to support these codes. The codes and their design were addressed during this last year and the hub board was designed and is currently in layout.

RESULTS

Considerable characterization and testing of the datalink was completed during this reporting period. Early results indicated the technical feasibility of the system, but also demonstrated how fragile and unreliable the prototype was. This refocused ViaSat's efforts on characterizing and stabilizing the current prototype for future demonstrations. Testing in late August confirmed transmission of up to 3 million bits on each link error free on several occasions. Given the design goal is 1 error every 100,000 bits, these were impressive results. In addition, tests conducted for another customer at this

same time, demonstrated an ability to transmit significant numbers of long and short messages error free. Finally, in late September the terminal unit was transported to Woods Hole Oceanographic Institute (WHOI) for a quick demonstration to the Office of Naval Research (ONR).

The prototype has been assembled, disassembled, and transported a number of times without affecting operation. The stability and reliability of the prototype unit has improved significantly, over the operation early in this reporting period.

IMPACT/APPLICATION

Successful demonstration of this effort would provide oceanographers the biggest advanced in telemetry in decades. This is necessary with all the recent advances in sensors and systems since even more capacity is needed to effectively use these new tools. Communication has long been a bottleneck for oceanographers, hopefully Oceanographic DataLink (ODL) will relieve this somewhat.

In addition, this datalink is the foundation for a low cost datalink for many other remote data applications including asset tagging and tracking, stolen vehicle recovery, and fixed site monitoring. This effort, in concert with the Air Force Global Location and Tracking System (GLTS), will demonstrate the use of the proposed datalink for both land and marine applications.

TRANSITIONS

This effort is one of two efforts currently under way by our team to demonstrate this datalink for remote data collection. ViaSat is leveraging a past design and common requirements to effectively utilize limited government resources to achieve demonstrations not possible within the cost constraints of a single STTR phase II effort.

There is already considerable interest in the oceanographic and government community in demonstrating this technology in a variety of applications. Additional funding has been added to both efforts to enhance the capabilities of the planned datalink and to support additional demonstrations. The planned demonstrations are key to continued interest and funding in this technology.

RELATED PROJECTS

GLTS, an Air Force SBIR Phase I and II effort to demonstrate the use of this datalink for global asset tagging and tracking. Phase I is complete, Phase II is underway. Additional funds and fixed site demonstrations were added to this effort during this reporting period. Joe Mancini at Rome Labs is the Air Force technical point of contact.

REFERENCES

December 1997. Oceanographic DataLink Phase I Final Report.

PUBLICATIONS

Gamache, K.A., 1998. Oceanographic Telemetry – The Future, Oceans Community Conference, Baltimore MD, November.

Gamache, K.A., P.E. Fogel, 1999. Oceanographic Datalink, *Oceans '99,* Seattle WA, September.